

PATENT APPLICATION

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

In re application of
Masamichi MORITA et al.

Docket No: Q86778

Appln. No.: 10/528,376

Group Art Unit: 1794

Confirmation No.: 6763

Examiner: Gerard T. Higgins

Filed: December 5, 2005

For: MATERIAL WITH PATTERN SURFACE FOR USE AS TEMPLATE
AND PROCESS FOR PRODUCING THE SAME

DECLARATION UNDER 37 C.F.R. § 1.132

Commissioner for Patents
P.O. Box 1450
Alexandria, VA 22313-1450

Sir:

I, Masamichi MORITA, hereby declare and state:

THAT I am a citizen of Japan;

THAT I have been a member of the research staff at Daikin Industries since 1991. I received my PhD degree in engineering from the Kyushu University in 2005. Then, I have been working on applied development of printable electronics; and

THAT I am familiar with the Office Action dated October 3, 2008 and the Advisory Action issued February 19, 2009.

I report below on certain experimentation that was conduct by me or under my direct supervision.

EXPERIMENTATION

A monomolecular film of a fluorine-containing compound was formed by using various fluorine-containing compounds. Then, dynamic wet characteristics (that is, receding contact angles) were measured.

The measurement methods (a fall method) of the receding contact angle are as follows:

5 μ L of n-hexadecane (or xylene) was dropped from a microsyringe on a substrate (a substrate having a fluoroalkylsilane monomolecular film) positioned horizontally, the substrate was inclined at a rate of 2 degrees/min, images till a droplet of n-hexadecane begins to slide were recorded as an animation with a video microscope. The animation was played, and the angle at the start of droplet slide was taken as a sliding angle. Further, a tangent line of the receding side during a droplet movement just after the start of droplet slide was taken as a receding contact angle.

The measurement results of the receding contact angle are shown in following Table 1.

Table 1 shows the result obtained by using the fluorine-containing compounds (a), (b), (c), (d), (e) and (f) recited in the present claim 1, and comparative compounds (Comparison A, Comparison B and Comparison C) excluded from the present invention.

Comparison A uses a compound having a linear chain C₄ perfluoroalkyl group and a silane group of carbon atoms 4 ($\text{CF}_3(\text{CF}_2)_3\text{-CH}_2\text{CH}_2\text{-SiCl}_3$, that is, nonafluorotetrahydrohexyl trichlorosilane).

Comparison B uses a compound having a linear chain C₆ perfluoroalkyl group and a silane group ($\text{CF}_3(\text{CF}_2)_5\text{-CH}_2\text{CH}_2\text{-Si(OCH}_3)_3$, that is, tridecafluorotetrahydrooctyl trimethoxysilane).

Comparison C uses a compound having a linear chain C₈ perfluoroalkyl group and a silane group ($\text{CF}_3(\text{CF}_2)_7\text{-CH}_2\text{CH}_2\text{-Si(OCH}_3)_3$, that is, heptadecafluorotetrahydrodecyl trimethoxysilane).

Comparison D uses a compound having a linear chain C₁ perfluoroalkyl group and a silane group ($\text{CF}_3\text{-CH}_2\text{CH}_2\text{-Si(OCH}_3)_3$, that is, trifluoropropyl trimethoxysilane).

This Experimentation does not include perfluoropropyl trimethoxysilane or perfluoroisopropyl trimethoxysilane, because perfluoropropyl trimethoxysilane or

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perfluoroisopropyl trimethoxysilane cannot be prepared due to an impossible direct bond between a perfluoroalkyl group and an Si atom.

Table 1

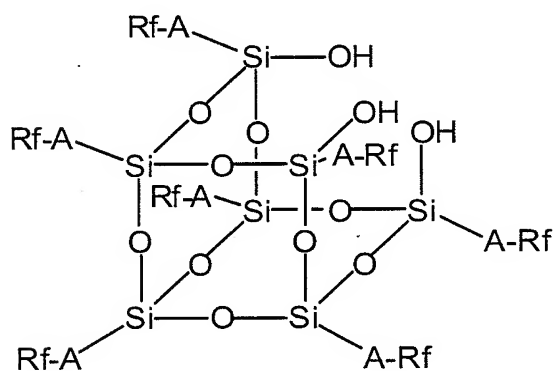
In claim 1	Abbreviations	Organic silane	n-Hexa-decane	Xylene
(a)	Br-Rf(C3)-Si	$(\text{CF}_3)_2\text{CFO-CH}_2\text{CH}_2\text{CH}_2\text{-SiCl}_3$	61	50
(a)	Br-Rf(C4)-Si	$(\text{CF}_3)_3\text{C-CH}_2\text{CH}_2\text{-Si(OCH}_3)_3$	62	52
(a)	Br-Rf(C5)-Si	$(\text{CF}_3)_2\text{CFCF}_2\text{CF}_2\text{-CH}_2\text{CH}_2\text{-Si(OCH}_3)_3$	62	58
(b)	PFPE-Si	$\text{C}_3\text{F}_7(\text{OCF}_2\text{CF}_2\text{CF}_2)_{20}\text{-OCF}_2\text{CF}_2\text{-CH}_2\text{CH}_2\text{-Si(OCH}_3)_3$	68	60
(c)	St-Rf(C4)-Ac-Si	$[(\text{CF}_3(\text{CF}_2)_3\text{-CH}_2\text{CH}_2\text{-OCOCH}_2\text{CH}_2)]_4\text{-SCH}_2\text{CH}_2\text{OCONH(CH}_2)_3\text{-Si(OCH}_3)_3$	62	52
(d)	St-Rf(C4)-Ur-Si	$\text{CF}_3(\text{CF}_2)_3\text{-CH}_2\text{CH}_2\text{-OCONH-(CH}_2)_3\text{-Si(OCH}_3)_3$	61	53
(d)	St-Rf(C4)-Es-Si	$\text{CF}_3(\text{CF}_2)_3\text{-CH}_2\text{CH}_2\text{-OCO-(CH}_2)_3\text{-Si(OCH}_3)_3$	63	49
(d)	St-Rf(C4)-Et-Si	$\text{CF}_3(\text{CF}_2)_3\text{-CH}_2\text{CH}_2\text{-O-(CH}_2)_3\text{-Si(OCH}_3)_3$	62	55
(d)	St-Rf(C4)-Am-Si	$\text{CF}_3(\text{CF}_2)_3\text{-CH}_2\text{CH}_2\text{-CONH-(CH}_2)_3\text{-SiX}_3$	60	52
(e)	St-Rf(C4)-POSS1	Structural formula (1) wherein Rf is Rf(C4) and A is CH_2CH_2	64	54
(f)	St-Rf(C4)-POSS2	Structural formula (2) wherein Rf is Rf(C4), A is CH_2CH_2 , and X is OC_2H_5	65	56
Comparison A	St-Rf(C4)-Si	$\text{CF}_3(\text{CF}_2)_3\text{-CH}_2\text{CH}_2\text{-SiCl}_3$	50	37
Comparison B	St-Rf(C6)-Si	$\text{CF}_3(\text{CF}_2)_5\text{-CH}_2\text{CH}_2\text{-Si(OCH}_3)_3$	55	45
Comparison C	St-Rf(C8)-Si	$\text{CF}_3(\text{CF}_2)_7\text{-CH}_2\text{CH}_2\text{-Si(OCH}_3)_3$	56	43
Comparison D	Rf(C1)-Si	$\text{CF}_3\text{-CH}_2\text{CH}_2\text{-Si(OCH}_3)_3$	44	36

Explanation of abbreviations for fluoroalkyl group:

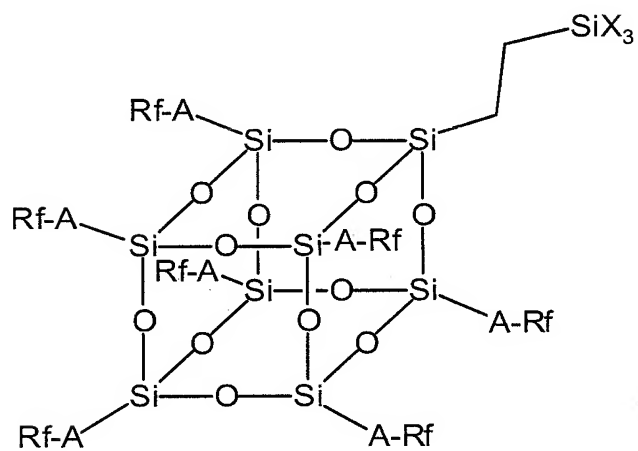
Br-Rf(C3) : Branched, 3 carbon atoms

St-Rf(C4) : Straight (linear), 4 carbon atoms

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Structural formula (1)



Structural formula (2)

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Table 1 shows that the fluorine-containing compounds (a) - (f) of the present invention have large receding contact angles to n-hexadecane and xylene in comparison with Comparisons A-C. In other words, it is found that the fluorine-containing compounds (a) - (f) of the present invention has the superior dynamic wet characteristics.

Table 1 shows that the compounds described in Paragraph [0017] of Ishida (JP2002-023356), Paragraph [0014] of Ishida (JP2001-284289), Paragraph [0019] of Furusawa (JP2001-284274), and page 5, line 13 of Katz (EP 1041652) are equivalent to Comparison B and Comparison C in Table 1 and that the effect of these compounds is inferior to the present invention. It can be understood that the present invention shows significantly advantageous effects in comparison with Ishida (JP2002-023356), Ishida (JP2001-284289), Furusawa (JP2001-284274) and Katz (EP 1041652).

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I declare further that all statements made herein of my own knowledge are true and that all statements made on information and belief are believed to be true; and further that these statements were made with the knowledge that willful false statements and the like so made are punishable by fine or imprisonment, or both, under Section 1001 of Title 18 of the United States Code, and that such willful false statements may jeopardize the validity of the application or any patent issuing thereon.

Date: 25, May, 2009

Masamichi Morita
Masamichi MORITA